

Listing and Amendments to the Claims

This listing of the claims will replace all prior versions and listings of the claims in the application.

1. (Currently amended) Method for digitally encoding a picture sequence, wherein the frames pictures of said picture sequence are arranged in macroblocks containing pixel blocks and the frames pictures are encoded in bi-predictive intra and predictive and/or intra bi-predictive coding types denoted B I, P and I B, respectively, and wherein said pictures form groups of pictures and each group includes one anchor picture and several non-anchor pictures, wherein a current picture is called an 'anchor picture' if all pictures that were previously encoded before this current picture precede it in display order, and a current picture is called a 'non-anchor picture' if there exists at least one previously encoded picture that follows the current picture in display order, and wherein adaptively, for the purpose of overall bit rate control, a specific frame picture target number of bits is assigned to these coding types, and wherein said overall bit rate control includes a frame picture-layer rate control and a macroblock-layer rate control which macroblock-layer rate control selects macroblock quantization parameters, said method comprising the steps:
 - assigning a target number of bits to anchor frames pictures but not assigning a target number of bits to non-anchor frames pictures;
 - coding the macroblocks of said anchor frames pictures using macroblock-layer rate control by adaptive macroblock quantization parameters, and coding the macroblocks of said non-anchor frames pictures without macroblock-layer rate control by using fixed macroblock quantization parameters.
2. (Currently amended) Apparatus for digitally encoding a picture sequence,

wherein the frames pictures of said picture sequence are arranged in macroblocks containing pixel blocks and the frames pictures are encoded in bi-predictive intra and predictive and/or intra bi-predictive coding types denoted B I, P and ± B, respectively, and wherein said pictures form groups of pictures and each group includes one anchor picture and several non-anchor pictures, wherein a current picture is called an 'anchor picture' if all pictures that were previously encoded before this current picture precede it in display order, and a current picture is called a 'non-anchor picture' if there exists at least one previously encoded picture that follows the current picture in display order,

and wherein adaptively, for the purpose of overall bit rate control, a specific frame picture target number of bits is assigned to these coding types, and wherein said overall bit rate control includes a frame picture-layer rate control and a macroblock-layer rate control which macroblock-layer rate control selects macroblock quantization parameters, said apparatus comprising:

- means for assigning a target number of bits to anchor frames pictures but not assigning a target number of bits to non-anchor frames pictures;
 - means for coding the macroblocks of said anchor frames pictures using macroblock-layer rate control by adaptive macroblock quantization parameters, and for coding the macroblocks of said non-anchor frames pictures without macroblock-layer rate control by using fixed macroblock quantization parameters.
3. (Currently amended) Method according to claim 1, wherein the quantization parameter used for the coding of non-anchor frames pictures in a current group of frames pictures is directly derived from the average quantization parameter of the previously encoded anchor frame picture belonging to that group.
4. (Currently amended) Method according to claim 1, wherein for the bit rate control for the anchor and non-anchor frames pictures inside a current one of

said groups a weighting factor $f_{Group-BP}$ or $f_{Group-I}$ is used, which weighting factors are adaptively controlled during the encoding of said picture sequence and specify the estimated ratios of the number R_{NA} of bits used for encoding a non-anchor frame picture to the number R_{A-BP} of bits required for encoding an anchor frame picture if it is coded as P or B frames picture, or R_{A-I} if it is coded as I-frame picture:

$$f_{Group-BP} = \frac{R_{NA}}{R_{A-BP}}, \quad f_{Group-I} = \frac{R_{NA}}{R_{A-I}} .$$

5. (Previously presented) Method according to claim 4, wherein for initialization at the beginning of encoding a picture sequence said weighting factors $f_{Group-BP}$ and $f_{Group-I}$ are set to:

$$f_{Group-BP} = \frac{1}{2}, \quad f_{Group-I} = \frac{1}{10} .$$

6. (Currently amended) Method according to claim 4, wherein based on a number $\hat{R}_{Group-BP}$ or $\hat{R}_{Group-I}$ of target bits for a current one of said groups, the frame picture target bit number \hat{R}_{A-BP} or \hat{R}_{A-I} for the anchor frame picture is:

$$\hat{R}_{A-BP} = \frac{\hat{R}_{Group-BP}}{(1 + N_{NA} \cdot f_{Group-BP})} \text{ or } \hat{R}_{A-I} = \frac{\hat{R}_{Group-I}}{(1 + N_{NA} \cdot f_{Group-I})} , \text{ respectively,}$$

wherein N_{NA} denotes the number of non-anchor frames pictures inside that current group, and whereby a corresponding accurate macroblock-layer rate control is used.

7. (Currently amended) Method according to claim 4, wherein the non-anchor frame picture or frames pictures of a current one of said groups are encoded using a fixed quantization step size of $Q_{NA} \approx 1.2 \cdot \overline{Q_A}$, where $\overline{Q_A}$ denotes the average quantization step size that was used for encoding the anchor frame picture of that group.

8. (Currently amended) Method according to claim 4 wherein, after a current one of said groups has been encoded completely, said weighting factors $f_{Group-BP}$ and $f_{Group-I}$ are updated in that weighting factors for said current group are determined by

$$\tilde{f}_{Group-BP}(n_{Group-BP}) = \frac{1}{N_{NA} \cdot R_{A-BP}} \cdot \sum_{k=1}^{N_{NA}} R_{NA}(k) \text{ or}$$
$$\tilde{f}_{Group-I}(n_{Group-I}) = \frac{1}{N_{NA} \cdot R_{A-I}} \cdot \sum_{k=1}^{N_{NA}} R_{NA}(k) \text{ , respectively,}$$

wherein $R_{NA}(k)$ is the number of used bits for the k-th non-anchor frame picture inside said current group, R_{A-BP} and R_{A-I} are the number of bits used for encoding the anchor frame picture as P/B-frame picture or as I-frame picture, respectively, and $n_{Group-BP}$ and $n_{Group-I}$ are continuously increasing indices for said weighting factors,
and wherein the weighting factors to be used for following groups are each calculated as corresponding average values of the weighting factors used for several, e.g. five, of the last encoded groups.

9. (Currently amended) Method according to claim 4 wherein, if Intra frames pictures are coded rarely, both said weighting factors $f_{Group-BP}$ and $f_{Group-I}$ are updated at the same time by using an adaptively controlled weighting factor $f_{BP-I} = R_{A-BP}/R_{A-I}$, which specifies the estimated bit rate ratio of anchor frames pictures coded as P/B-frames pictures and anchor frames pictures coded as I-frames pictures, such that $f_{Group-I} = \frac{f_{Group-BP}}{f_{BP-I}}$.

10. (Currently amended) Method for digitally decoding an encoded picture sequence, wherein the frames pictures of said picture sequence are arranged in macroblocks containing pixel blocks and the frames pictures were encoded in bi-predictive intra and predictive and/or intra bi-predictive

coding types denoted B I, P and I B, respectively, and wherein said pictures form groups of pictures and each group includes one anchor picture and several non-anchor pictures, wherein a current picture is called an 'anchor picture' if all pictures that were previously encoded before this current picture precede it in display order, and a current picture is called a 'non-anchor picture' if there exists at least one previously encoded picture that follows the current picture in display order,

and wherein adaptively, for the purpose of overall bit rate control, a specific frame picture target number of bits was assigned to these coding types, and wherein said overall bit rate control included a frame picture-layer rate control and a macroblock-layer rate control which macroblock-layer rate control had selected macroblock quantization parameters, wherein a target number of bits was assigned to anchor frames pictures but was not assigned to non-anchor frames pictures,

and wherein the macroblocks of said anchor frames pictures were coded using macroblock-layer rate control by adaptive macroblock quantization parameters, and the macroblocks of said non-anchor frames pictures were coded without macroblock-layer rate control by using fixed macroblock quantization parameters, said method including the step of:

- decoding said anchor frames pictures using correspondingly adaptive macroblock quantization parameters, and decoding said non-anchor frames pictures using only fixed macroblock quantization parameters.